

Operating manual

Burner for regenerative firing
Bloom Series 1100/1150 Ultra³ Low NO_x™





This operating manual contains important information for the safe operation of the burner/regenerator system. Always strictly adhere to the instructions in this document to protect yourself and others from injury.

Familiarise yourself with the applicable statutory accident prevention and general safety regulations.

Always carefully read this operating manual before carrying out any work on the unit! This manual is an integral part of the burner and must be at all times be accessible to all personnel near the unit.

When transferring the unit to another party, also hand over the manual.

The illustrations in this manual are intended to clarify certain points. They might not be to scale or depict a unit that deviates from the design of your equipment.

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1 Summary description

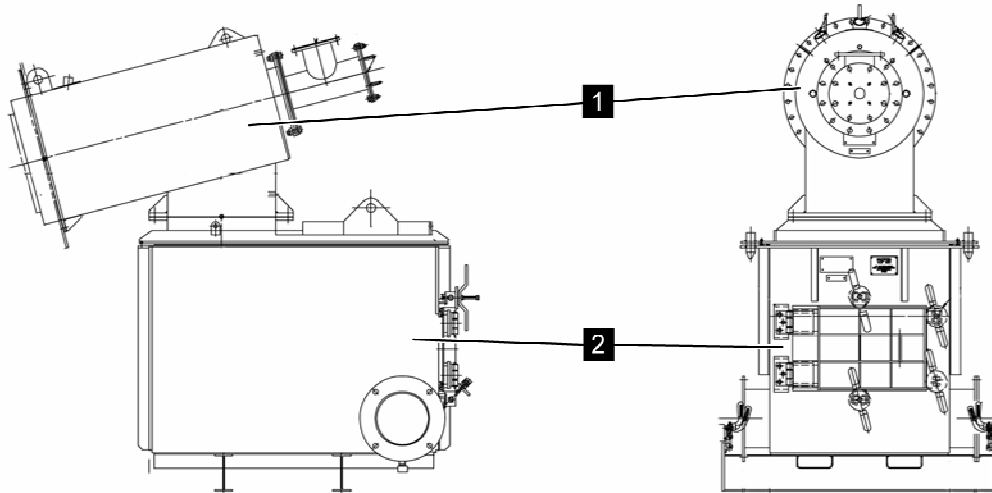


Fig. 1: Burner and regenerator

The complete burner/regenerator system consists of two burners (1) and regenerators (2) of the same type, that are used to heat up a single furnace chamber. In addition to the burners and regenerators, the unit must include a number of peripheral devices (fans, valves, media supply lines, MCR equipment). The burner system must be properly connected to the other components of the unit.

The burners are operated in reversion mode. In this mode, one of the two burners is firing, while the other extracts a large part of the fumes (approx. 85%) from the furnace chamber.

By extracting the combustion product, the ceramic media bed in the regenerator of the extracting burner is heated up. The heat stored in the ceramic beads is subsequently released to the combustion air when the burner is switched over to firing mode.

In reversion mode, the burners are switched at fixed cycle times from burner to extractor operation and vice versa.

General

2 General

2.1 About this manual

- ⚠ This operating manual contains important information for the safe operation of the burner/regenerator system. Always strictly adhere to the instructions in this document to protect yourself and others from injury.

Familiarise yourself with the applicable statutory accident prevention and general safety regulations.

Always carefully read this operating manual before carrying out any work on the unit! This manual is an integral part of the burner and must be at all times be accessible to all personnel near the unit.

When transferring the unit to another party, also hand over the manual.

The illustrations in this manual are intended to clarify certain points. They might not be to scale or depict a unit that deviates from the design of your equipment.

In addition to this manual, always adhere to the instructions in the separate manuals of other built-in components.


Instructions in the manuals of supplied components have precedence over the instructions in this operating manual.

2.2 Symbols

Warning

Warnings in this manual are identified with the warning symbol (⚠) and/or appropriate warning texts. These expressions indicate the severity of the potential risk.

Always strictly adhere to the instructions and proceed with great care to prevent accidents, injury and damage to property.

Warning symbol /warning text	Explanation
⚠ DANGER or DANGER!	Indicates a situation that, if not avoided, will result in serious injury or death.
⚠ WARNING or WARNING!	Indicates a situation that, if not avoided, might result in serious injury or death.
⚠ CAUTION or CAUTION!	Indicates a situation that, if not avoided, might result in minor injury.
IMPORTANT or IMPORTANT !	Indicates a potentially dangerous situation that, if not avoided, might result in damage to property.
Tips and hints	Explanation
	Indicates tips and recommendations as well as other information required for the efficient and disruption-free operation of the burner unit.

General

2.3 Liability

All information and instructions in this operating manual have been compiled with reference to the applicable standards and regulations, best practice and our extensive expertise and experience in this field.

The manufacturer shall not be liable for damage caused by:

- Non-compliance with instructions in this manual
- Improper use
- Operation by insufficiently qualified personnel
- Unauthorised modifications to the equipment
- Technical modifications
- Use of unapproved spare parts

The actual scope of delivery might vary from that described in this document and shown in the drawings. This is particularly the case with customised models, where additional options are ordered or where changes were made to the equipment, due to technical development.

The supply of the equipment is subject to the terms of the order contract, the general business terms and conditions of the manufacturer, the manufacturer's delivery terms and the statutory regulations applicable at the time of closing of the contract.

We reserve the right to make technical modifications in order to improve usability.

2.4 Copyright

Copyright 2007, Bloom Engineering (Europa) GmbH

The information included in this operating manual and associated documents is the intellectual property of Bloom Engineering (Europa) GmbH and is protected by international copyright.

The information compiled in these documents is intended to ensure safe operation, maintenance and troubleshooting of the equipment to which they refer.

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Bloom Engineering (Europa) GmbH shall not be liable for damage caused by the improper use of the information.

Bloom Engineering (Europa) GmbH reserves the right to retract, review and modify its products as well as the information in this manual at any time and without prior notice.

2.5 Spare parts

WARNING

Use only original spare parts available from the manufacturer! Incorrect or defective spare parts might impair the safety of the equipment and lead to damage, malfunction or total failure of the unit, injury to people or even cause death.

Order spare parts from Bloom Engineering.
For address details, see page 2.

General

2.6 Warranty terms

Unless the parties have entered into a separate extended warranty agreement, the warranty terms laid down in the general business terms and conditions of Bloom Engineering apply.

2.7 Customer Service

Our Customer Service is always available for technical information.

Notes on the responsible contact partner are on call by phone, fax, e-mail or via internet, see address of manufacturer on page 2.

Apart from that, our members of staff are permanently interested in receiving new information and experience resulting from the use of our products and which could be of great value for future improvements.

3 Safety

This paragraph provides an overview of all important safety aspects for optimal protection of personnel as well as safe and trouble-free operation.

Disregarding this Manual and safety regulations specified therein may result in considerable danger.

3.1 Customer's responsibility

3.1.1 General

The unit is designed for commercial use. The operator of the unit is therefore bound by the relevant occupational safety legislation.

In addition to the safety instructions in this manual, all statutory occupational health and safety, accident prevention and environmental protection regulations must be strictly adhered to. This applies in particular to:

- The operator is obliged to keep himself informed of the applicable workplace safety regulations. He must also be in a position to identify and assess risks that might occur in connection with the specific conditions at the location of operation of the unit. The results of such a risk analysis must be implemented in the form of operating instructions for the operation of the unit. Danger areas must be identified as such and cordoned off, if applicable (barriers, danger warnings, prohibited access).
- During the entire period of service of the unit, the operator must ensure that the operating instructions issued by him are kept up to date and conform to the latest version of the relevant standards and regulations.
- The operator must assign clear responsibilities for the installation, operation, maintenance and regulation of the unit.
- It is the responsibility of the operator to ensure that all employees involved in the operation of the unit have read and understood the instructions in this manual.
In addition, all personnel must be regularly trained and informed of potential risks.
- The operator must provide personnel with suitable personal protective equipment.

He must also ensure that the unit is at all times in proper working order, which includes the following:

- Compliance with the maintenance schedule prescribed in this operating manual.
- Regular testing and inspection of the safety guards and devices.

Safety

3.1.2 Design criteria

It is the responsibility of the operator to ensure that the lines and devices installed for the supply of the unit with fuel and combustion air are of suitable capacity and conform to the latest state of technology and the applicable statutory regulations.

In EU member states, these regulations are found in the EN 746-2 standard as amended.

3.2 Personnel requirements

3.2.1 Qualifications

WARNING

Only persons who are qualified for a particular task are permitted to carry it out! Improper handling of the equipment can lead to serious injury to persons and damage to equipment.

The following qualifications for the various tasks are specified in this operating manual.

- **Instructed person (production personnel)**
Person who was instructed about the tasks assigned to him/her and the potential risks arising from improper behaviour.
- **Specialist personnel**
Person who, due to his/her professional training, skills and experience, and knowledge of the relevant regulations, is in a position to carry out the work assigned to him/her and to identify and avoid potential risks.
- **A professional electrician**
based on his/her professional training, know-how and experience as well as knowledge of the applicable standards and regulations is able to perform work on electrical systems and to detect and avoid possible dangers on his/her own.
The professional electrician has been trained for the special location where he/she works and knows the relevant standards and regulations.
- **Specialist technician with special qualification in the handling of fuels**
Due to their technical training, knowledge, experience and familiarity with the relevant standards and statutory regulations, such persons are in a position to carry out work in connection with the fuel supply of the unit and to identify possible risks.

Specialist technicians with the above skills are trained specifically for the location of operation at which they work.

Only persons of whom it may be expected that they perform their work reliably are permitted as personnel. Persons whose reaction capability is impaired, e.g. through drugs, alcohol or medication are not permitted.

- When selecting the personnel, the stipulations regarding age and occupation applying at the location must be observed.

3.2.2 Unauthorised persons

WARNING

**Keep unauthorised persons away from the working area!
If in doubt, approach persons and ask them to leave the working area!**

Interrupt the work, if there are unauthorised persons in the working area!

Unauthorised persons tend not to be aware of the potential risks in the working area. Their presence in the working area might result in serious injury or even death, as workers might be distracted by them.

Safety

3.3 Proper use

The unit is exclusively designed for the intended use described here.

The burner/regenerator system must only be used to heat industrial furnaces and crucibles for melting or heat treatment. Typical applications include the melting of aluminium and other methods, the heating of steel ingots prior to further machining in roller trains, forges, etc.

Proper use included compliance with all instructions in this manual.

WARNING! The use for any other purpose is forbidden! Any use for other purposes than those specified in this document is deemed improper and can result in dangerous situations.

The manufacturer shall not accept any liability for claims for compensation based on damage caused by improper use.

3.4 Manufacturer's Declaration

The burners and regenerators provided by the manufacturer are not designed for operation as stand-alone units. They are designed for integration into an overall plant where they become functioning unit components.

The manufacturer therefore issues individual Manufacturer's Declarations for each supplied burner or regenerator, confirming compliance with the relevant standards and suitability of the equipment for installation in the specified unit. The Manufacturer's Declaration is included in the documentation of the respective burners/regenerators.

3.5 Personal protective equipment

Wearing of personal protective equipment is required when working to minimize the health hazards.

- Always wear the protective equipment that is necessary for the respective task when working.
- Follow the instructions on personal protective equipment that are posted in the work area.

Wear generally

Generally wear for all kind of work:



Protective clothing

are tight fitting working clothes with low tear resistance, with light sleeves and without any sticking out parts. These clothes are mainly a protection against being caught by moving machine parts.

Do not wear rings, chains, necklaces, and other jewellery.



Hard hat

to protect against parts and materials falling down and flying around.



Safety boots

to protect against heavy parts falling down or slipping on slippery ground.



Protective gloves

to protect the hand against friction, graze, punctures or deep cuts as well as contact with hot surfaces.

To be worn for special tasks

When carrying out work inside or close to the burners and regenerators, it might be necessary to wear respiratory protection equipment.

It is the responsibility of the unit operator to carry out an air analysis, if necessary, and to instruct the personnel to use suitable respiratory protection equipment.



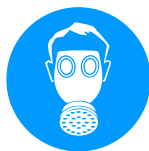
Protective goggles with coloured glass (furnace glass)

Protection of the eyes against glare

Safety



Light breathing mask
as protection against hazardous dusts.



Respirator, recirculated air dependent

for protection against harmful gases, vapours, dusts and similar materials and media.

If a permitted limit value is exceeded by more than 100 times, an insulated respirator must be used.

The respirator must only be used if there is at least 17% oxygen in the air.

3.6 Special dangers

The following section lists the known residual risks.

⚠ DANGER

Always observe the safety instructions and warnings in this and all following chapters in this manual. They are designed to reduce the risk to your health and to prevent dangerous situations!

Suspended loads

DANGER! Never stand under suspended loads!

Move load only under supervision!

When leaving the workplace, ensure that all loads are properly placed on the ground.

Dropping loads can cause serious injury or even death.

Highly flammable substances

WARNING! Do not smoke in the danger area or its vicinity! Do not use naked flames or other ignition sources!

Keep a suitable fire extinguisher nearby!

Immediately notify your supervisor if you detect any suspicious substances, liquids or gases!

In the event of a fire, immediately shut down the unit and stop working. Leave the danger area until you are instructed that it is safe to return to your workplace!

Highly flammable substances, liquids and gases can ignite and cause serious injury or even death.

Explosive dusts

WARNING! Do not smoke; use naked flames and/or ignition sources of any type near the unit and in the hall!
Keep the danger area dust-free.
In the event of dust formation, stop working. Wait until the dust has settled and then remove it.
Dust deposits can be whirled up so that the particles become airborne forming a dangerous explosive atmosphere.

Hazardous dusts

WARNING! When working in the danger area, always wear light-duty respiratory protection equipment!
If dust is inhaled over a long period, it might cause damage to lungs or other vital organs.

Hot working materials

WARNING! Before handling working materials, ensure that they are not hot! If necessary, let them cool down!
Working materials can reach high temperatures during operation and can therefore cause injury from burns.

Forklift trucks

WARNING! Forklift trucks must be driven by suitably trained operators!
Use only approved forklift trucks with the necessary load capacity!
Never transport suspended goods across areas where persons are standing!
Overtake or walk beside forklift trucks only if the driver indicates to you that he/she has seen you!
When transporting goods on forklift trucks, there is a risk that they might become dislodged, causing serious injury!
There is also a risk that forklift truck operators fail to see a person in their path and thus cause a collision.

Sharp edges and pointed corners

CAUTION! Proceed with great care when working near sharp edges and pointed corners!
If in doubt, wear protective gloves!

Safety

Hot surfaces

CAUTION! During all work near hot component parts, always wear protective clothing and gloves!

Before commencing work, ensure that all components are cooled down to ambient temperature!

Skin contact with hot parts and surfaces can lead to injury from burns.

Naked flame

CAUTION! During all work near naked flames, wear additional protective equipment!

Never look into the flames without special goggles! Keep a safe distance from the flames!

There is a risk of burns and damage to eyes, even if direct contact with the flames is avoided!

Dirty and untidy workplaces

CAUTION! Always keep the working area clean and tidy!

Clear away equipment and tools that you don't need!

Mark trip hazards with yellow and black marking tape!

There is a risk that people might trip or slip on dirt and tools left on the floor!

3.7 Protective devices

WARNING

At the beginning of the shift, check whether the safety devices are properly installed and in working order.

Never disable safety devices!

Ensure that safety devices such as emergency-stop buttons, rip cords, etc. are accessible at all times!

The safety of the unit depends on properly working safety devices. In the event of defective or disabled safety devices, there is a serious risk to life and limb!

IMPORTANT

The surfaces of the burner and regenerator become very hot during normal unit operation. The unit operator must ensure that the unit is equipped with suitable safety devices and guards at suitable distances to each other. He must also carry out regular function checks of these devices.

Necessity of integrated emergency-stop concept

The burners/regenerators are designed for integration into an overall unit. They are not equipped with a separate control system or independent emergency-stop function.

It is the responsibility of the unit operator to ensure that the equipment is protected by a suitable emergency-stop concept and that the necessary emergency-stop circuits are integrated into the unit control system and conform to the relevant regulations.

3.8 Securing unit against inadvertent start-up**⚠ DANGER**

When restarting the unit, always follow the instructions below! Adhere to the instructions in this manual for the securing of the unit against unauthorised start-up!

When working in the danger area, you are at risk of serious injury or even death if the power supply to the unit is inadvertently switched on.

1. Shut off the gas supply by closing the respective tap or valve.
2. Switch off the burner control system and secure it against inadvertent switching on.

3.9 Operator behaviour in the event of an emergency

If the unit operator has drawn up an contingency plan for emergencies, adhere to it in the event of an emergency or accident.

If no such contingency plan is in place, follow the instructions below.

Preventive measures

- Always be prepared for an accident or fire!
- Keep fire extinguishers and first-aid equipment (first-aid kit, blankets) ready.
- Ensure that all personnel are familiar with the alarm, emergency, first aid and rescue equipment.
- Ensure that the access routes for rescue vehicles are kept free at all times.

Safety

Measures to be taken in the event of an accident

- Stop the unit by pressing an emergency-stop button.
- Take suitable first-aid measures.
- Remove persons from the danger area.
- Alert the plant supervisor.
- Contact the emergency services.
- Ensure that the access routes for rescue vehicles are kept free at all times.

3.10 Environmental protection measures

IMPORTANT

Always adhere to the instructions below!

If polluting substances have inadvertently been released, take the necessary measures to prevent damage. If in doubt, contact your local environmental protection authorities and inform them of the incident!

Incorrect handling of pollutants, and in particular improper disposal of such substances, can lead to serious damage to the environment.

The following polluting substances are used:

Lubricants

Lubricants like greases and oils contain toxic substances. These must not be released into the environment. They must be disposed of by a special waste disposal company.

Propane, natural gas and city gas

The gases do not have a direct adverse effect on the environment. In the event of a gas leak, attempt to stop the gas from escaping. Prevent the gas from entering the sewage system, basements, excavated pits and other areas where it could pose a hazard.

Light and heavy heating oil

Fuels such as light and heavy heating oils contain toxic substances and can pollute surface and ground water. They may not be released into the environment and must be disposed of through a specialist waste disposal company.

In the event of a leak, attempt to stop the heating oil from escaping. Prevent it from seeping into the ground and from entering basements or the sewage system by early intervention with suitable binding agent.

Insulation

The insulating materials used in the burners, regenerators and refractory concrete might contain mineral fibres that might become airborne.

Always dispose of insulating material in accordance with the instructions of the manufacturer (see material safety data sheets) and the applicable statutory waste handling regulations.

3.11 Signage

It is the responsibility of the unit operator to ensure that there are appropriate safety, warning and operating signs attached to the unit. These signs must be legible at all times.

The unit operator must inform all personnel of the possible risks and dangers associated with the unit and instruct them to adhere strictly to the instructions on attached signs.

Technical data

4 Technical data

The burner/regenerator system is accompanied with a data sheet listing the applicable technical data.

Emissions

Noise emission

The noise emission of a properly installed burner during operation is indicated on the type plate
(⇒ *Type plate*).

4.1 Type plate



Fig. 2: Type plate

The type plate is attached to the burner or regenerator at an easily accessible position and depends on the unit configuration
(⇒ *Installation drawing of the unit operator*). It contains the following information:

- Manufacturer name and address
- Year of manufacture
- Type
- Reference number
- Rated power (max., min.)
- Noise emission
- Fuel
- Atomization medium (for heating oil-fuelled units)
- Calorific value of the fuel
- Pressure range
- Temperature range
- Fuel consumption

5 Structure and function

5.1 Overview

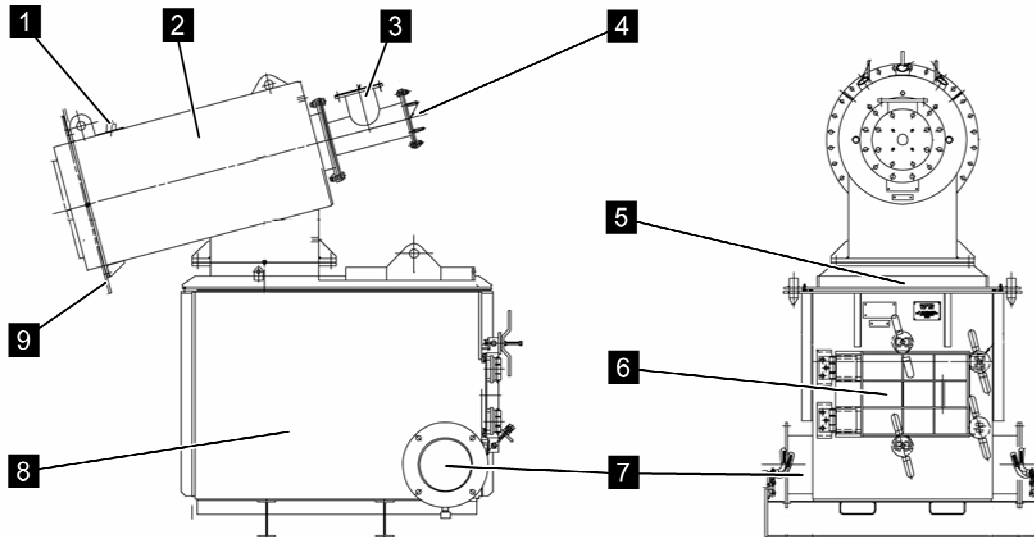


Fig. 3: Burner (type 1150)

- | | | | |
|---|---|---|---|
| 1 | Support for the pilot burner | 6 | Discharge gate (model 1) |
| 2 | Burner | 7 | Combustion air / combustion product inlet
(type 1150: secondary air) |
| 3 | Primary air connection (only in type 1150) | 8 | Regenerator |
| 4 | Gas connection | 9 | Connecting flange of furnace chamber |
| 5 | Filling gate (at top side of regenerator, not depicted) | | |

Structure and function

5.2 Functional description

The complete burner system consists of two burners and regenerators of the same type that are used to heat up a single furnace chamber.

The burners are operated in reversion mode. In this mode, one of the two burners is firing, while the other extracts a large part of the combustion products (approx. 85%) from the furnace chamber.

By extracting the combustion product, the ceramic media bed in the regenerator of the extracting burner is heated up. The flue gas is cooled down to a temperature of max. 200 °C.

During firing, the heat stored in the ceramic media bed is transferred to the combustion air, which is thereby pre-heated to a temperature of about 150 °C below the achieved furnace chamber temperature.

In reversion mode, the burners are switched at intervals of approx. 40 seconds from burner to extractor operation and vice versa.

Control and baffle system

The fully automatic control system controls the switchover between the burners by actuating a system of baffles. The control system and baffles are not included in the burner/regenerator system.

Please observe the instructions in the separate documentation and operating manuals of the control elements.

Difference between burner models 1100 and 1150

The systems 1100 and 1150 differ primarily in the combustion air inlet.

In 1150 burners, the primary and the secondary combustion air is fed through separate lines from the outside, while in system 1100 models, the air enters the burner unit through one single inlet and is then distributed inside the burner.

5.3 Description of assemblies

5.3.1 Burner

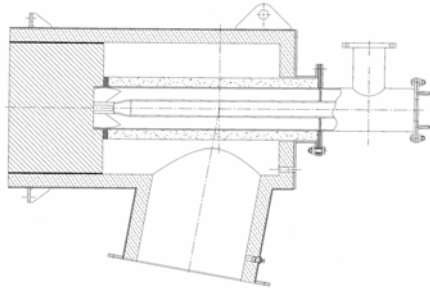


Fig. 4: Burner

The burner consists of

- Burner housing
- Burner block
- Gas lance/oil lance (⇒ separate manual)
- Primary air lance with external refractory casing (only in type 1150)
- Swirl plate

Burner housing

The burner housing consists of a welded steel structure with refractory internal insulation. The gas lance is mounted at the centre of the burner housing. In type 1150, the gas lance is located at the centre of a primary air lance.

To protect the gas supply line to the gas lance from the high temperatures in the burner housing, the gas lance is enclosed in refractory material.

Both lances are attached with a seal to the burner block where the gas is mixed with the combustion air.

The burner block can be equipped with a swirl plate as an option. The swirl plate generates a special flame geometry, where tailored whirls at the edge of the flame ensure optimum combustion with minimum NO_x formation.

Line to pilot burner

The burner system includes a gas/air pilot burner whose function is described in a separate manual.

Burner monitoring system

The unit features a connecting piece for the installation of a UV probe for the monitoring of the main flame. The function of the UV probe is described in a separate manual.

Type 1150: operating temperature range

At operating temperatures below 950 °C, the combustion air consists of 80 % pre-heated secondary air from the regenerator and 20 % cold primary air. The cold primary air also serves to cool the lances.

At operating temperature above 950 °C the combustion air consists nearly entirely of pre-heated secondary air from the regenerator. A share of 5 % of the cold primary air is required at all temperatures for the cooling of the lances.

Type 1100

In type 1100, the combustion air always consists of warm air fed from the regenerator.

Structure and function

5.3.2 Regenerator

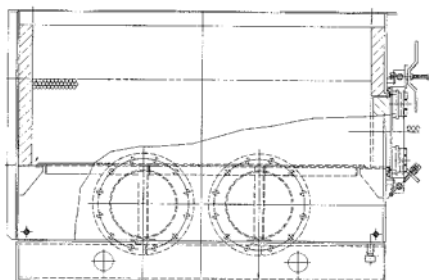


Fig. 5: Regenerator

Similar to the burner housing, the regenerator housing consists of a welded steel structure with refractory internal insulation. Depending on the unit configuration, the regenerator is located above or below the burner.

The regenerator features a grate on which the ceramic beads made from Al₂O₃ are placed.

In extraction mode, the combustion products extracted from the furnace chamber are fed through the ceramic media bed and the beads are heated up by the residual heat of the combustion products. In burner mode, the heat stored in the media bed pre-heats the cold secondary air.

5.4 Connections

All components of the burner system must be connected to each other and with the combustion air and the fuel gas supply lines according to the installation drawings which take into account the capacity of the burner unit and the conditions at the site of installation.

5.5 Working areas

For permanently installed regenerators

- The gates at the front and on top of the regenerator must be easily accessible as they are used to add and remove ceramic beads.
Observe the opening range of the gates.

For portable regenerators

- To add and remove ceramic beads, the regenerators are temporarily removed from the unit.
Ensure that there is sufficient space to swivel and transport the regenerators from the location of operation to the place of storage and maintenance.

5.6 Operating elements

5.6.1 Gates at the regenerator

Discharge gate model 1



Fig. 6: Discharge door with locking levers

- This type of gate can be opened without the need for tools.
- It is equipped with a hinge.

Discharge gate model 2



Fig. 7: Discharge gate with bolted cover

- To open this gate, you need a spanner.
- The cover is not hinged. When all bolts are removed and the cover is lifted from the machine, it must be placed on the floor or attached to lifting gear.

Filling gate



Fig. 8: Filling gate

- To open the filling gate, you need a spanner.
- When all bolts are removed and the cover is lifted from the machine, it must be placed on the floor or attached to lifting gear.

Structure and function

5.7 Operation modes

The burners can be operated in the following modes:

- Burner mode / extractor mode
(regenerative mode, normal operating mode)
- Cold air mode (emergency operating mode)
- Cooling mode (preparation for maintenance)

Normal operating mode

The burners are operated in reversion mode. This means that the two burners switch between burner and extractor mode at fixed cycle times.

Emergency mode

In the event of a malfunction or fault, the burners can be operated in emergency mode, whereby only cold combustion air is used. In emergency mode, no pre-heated combustion air is fed.

If only one burner of the system is used, the unit control must ensure that the regenerator of the shut-down burner does not overheat.

Cooling mode

After the burner has been switched off, cooling of the unit can be accelerated by feeding cold air through the burners and regenerators.

This function is particularly useful to prepare the unit for maintenance or repair work.

6 Transport, packing and storage

IMPORTANT

At the request of the customer, the units are installed and commissioned by a technician of the manufacturer or another person authorised by the manufacturer. During the installation work and subsequent procedures, operating and/or maintenance staff of the machine operator might be requested to handle parcels. If this is the case, the following instructions must be adhered to.

6.1 Safety notes for transport

⚠ WARNING

Never stand under suspended loads!

Attach the lifting tackle only at the provided attachment points!

Do not attach lifting tackle to protruding machine parts or eyelets at mounted components! Ensure that the tackle is properly secured!

Use only suitable lifting gear and tackle with the necessary load capacity!

Do not use frayed or worn ropes, belts and cables!

Do not place cables or belts around sharp edges! Do not knot or twist cables or belts! To avoid dangerous situations and damage to equipment, always strictly adhere to the safety instruction and warnings!

When lifting loads, there is a risk of serious injury or even death from parts that become dislodged or begin to swerve erratically.

⚠ WARNING

Observe the safety instructions and symbols on the packaging!

Attach the crane hook in such a way that it is located directly above the centre of gravity!

Carefully lift the goods and check whether there are signs of tipping!

If necessary, change the attachment!

The centre of gravity of packed goods might not be at the geometric centre of the parcel. If attached incorrectly, parcels might tip over, causing serious injury or even death.

Transport, packing and storage

⚠ CAUTION

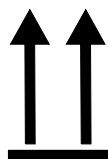
When unloading parcels after delivery or during internal transportation, proceed with great care and always observe the symbols and instructions printed on the packaging! Attach the lifting tackle only to the attachment points provided! Remove the packaging only immediately before installing the respective part!

Improper transport can cause serious damage to the equipment.

6.2 Symbols on packaging

The symbols listed here are widely used, but sometimes omitted from packaging.

Other signs and symbols can be applied to the packaging at the request of the customer. It is the responsibility of the unit operator to ensure that all personnel involved in the transportation of the goods adhere to the instructions.



Top

The arrows in this sign symbolize the top side of the package. They must always point up, as otherwise the content may get damaged.



Fragile

Identifies packages with fragile or sensitive content.

Handle package with care, do not drop and do not subject to shock loads.



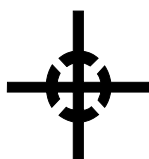
Protect against wetness

Protect packages against wetness and keep dry.



Fasten lifting tackle here

Attach lifting tackle (chain, lifting belt) only at points marked with this symbol.



Centre of gravity

Marks the centre of gravity of packages.

Observe the position of the centre of gravity for lifting and transport.

Transport, packing and storage



Weight, lifted load

Identifies the weight of packages.

The marked package must be handled as appropriate for its weight.

6.3 Transport inspection

Upon receipt of the goods, inspect the delivery for completeness and visible damage caused during transportation.

If there is visible damage caused by transportation, proceed as follows:

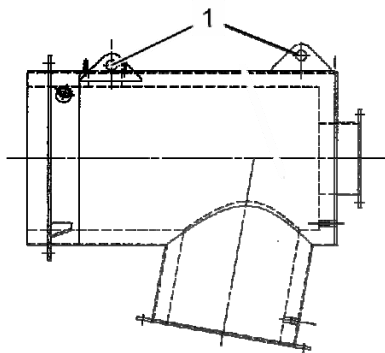
- Do not accept the delivery, or accept it with reservations.
- Note the damage in the transport dockets or the delivery note of the carrier company.
Take pictures of the damage.
- Complain without delay.

IMPORTANT! Always make a complaint the moment you detect a defect!

Claims for compensation for damages shall only be considered, if the complaint was made on time.

6.4 Transport

Attachment points



The following attachment points are provided:

- To lift the burner, attach the lifting tackle to the attachment eyelets (1) located at the top of the burner.
For detailed instructions, refer to the respective design and installation drawing.

Fig. 9: Attachment points at burner

Transport, packing and storage

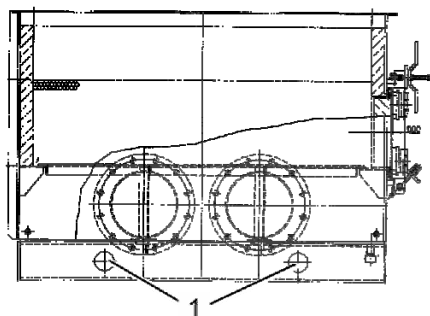


Fig. 10: Attachment points at regenerator housing

- To lift the regenerator, attach the lifting tackle to the holes (1) at the base of the regenerator. For detailed instructions, refer to the respective design and installation drawing.

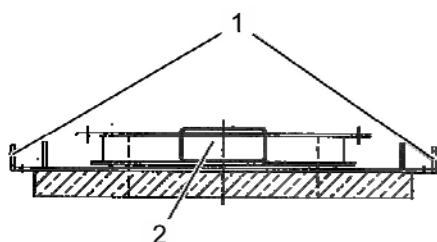


Fig. 11: Attachment points at regenerator cover

- To lift the regenerator cover, attach the lifting tackle to the attachment eyelets (1). The filling gate cover can also be lifted with a forklift truck, as it is equipped with recesses for the forklift arms (2). For detailed instructions, refer to the order-specific design and installation drawing.

IMPORTANT! Never use the attachment points of the cover to lift the entire regenerator!

Never use the recesses for the forklift arms (2) to lift the entire regenerator cover! To do this, always attach the tackle to the attachment eyelets (1)!

6.5 Packing

Packaging

The individual parcels are packed to protect the goods during transport.

The packaging must also protect the individual parts against corrosion and other damage prior to installation. Therefore do not damage the packaging and only remove it immediately prior to installation of the component.

Handling of packaging material

Dispose of the packaging material according to the statutory waste management regulations.

IMPORTANT! Packaging material should be disposed of in an environmentally friendly manner! Observe the applicable statutory regulations! If appropriate, contract a specialist waste management company with the disposal of the packaging!

Some packaging material can be recycled or reused. Improper disposal can cause damage to the environment.

6.6 Storage

Storage of parcels

Store the parcels under the following conditions:

- Do not store outdoors.
- Store in a dry and frost-protected room.
- Do not expose to aggressive media.
- Avoid mechanical impact or vibration.
- Avoid condensation.

CAUTION! Store parcels in a dry environment! In the event of prolonged storage, regularly check the desiccant and replace it, if necessary!

Storage in a humid environment can cause damage from moisture penetrating the refractory lining. During the heating-up process, the water in the lining might evaporate suddenly, causing cracks and flaking of the insulation.

- If goods are stored for more than 3 months, regularly check all parts and the packaging for damage or moisture. If necessary, replace the desiccant.

IMPORTANT ! Under certain circumstances, the parcels are delivered with special instructions for storage, which exceed the general instructions in this manual. Always adhere to the special instructions!

Installation and commissioning

7 Installation and commissioning

IMPORTANT

At the request of the customer, the units are installed and commissioned by a technician of the manufacturer or another person authorised by the manufacturer. Normally, the installation and commissioning procedures are supervised by an experienced topping-out foreman of the manufacturer.

If the customer/operator wishes to carry out the installation work without assistance from the manufacturer, he shall be responsible to ensure that all relevant standards and safety regulations have been adhered to and that all work is carried out to best practice.

7.1 Safety instructions for installation

⚠ DANGER

Before carrying out any work at the units, disconnect the electric power supply and secure it against inadvertent reconnection!

Contact with powered components can cause death. Powered parts might perform unexpected movements that can cause serious injury.

⚠ DANGER

Before carrying out any work at the units, disconnect the electric power supply and secure it against inadvertent reconnection!

During installation work, you are at serious risk of death if the power supply to the unit is inadvertently switched on.

⚠ WARNING

All work in connection with the installation and commissioning of the unit must be carried out by qualified specialist personnel!

These tasks require special skills, knowledge and experience. Incorrect installation can lead to dangerous situations, where lives might be risk.

Installation and commissioning

⚠ WARNING

Before starting any work, ensure that you have the necessary room for manoeuvre!

Proceed with great care when handling components with sharp edges!

Keep the unit site clean and tidy! Loosely stacked components and tools can cause injury!

Mount all components according to best practice! Tighten the bolts with the prescribed tightening torques!

if necessary, secure components to prevent them from falling or tipping!

Improper installation and commissioning can result in serious injury or damage to property.

Personnel

- Installation and commissioning may be executed only by specially trained personnel.
- All work on the electrical system must be performed by a qualified electrician.

Personal protective equipment

The following personal protective equipment must be worn when installing and commissioning the unit:

- Protective goggles
- Hearing protection
- Protective clothing
- Hard hat
- Safety footwear
- Protective gloves

IMPORTANT! A warning symbol in this chapter indicates whether additional protective equipment is required for specific work.

Installation and commissioning

7.2 Preparations

The unit operator or the installation contractor must ensure that the following issues are duly considered before the commencement of the installation work:

- During all work, always adhere to the applicable safety regulations and document all steps as required.
- Strictly adhere to the order-specific design and installation drawing supplied by the manufacturer.
Instructions in the design and installation drawings have precedence over the instructions in this operating manual.

IMPORTANT! All components and parts of the equipment must be positioned and connected with each other as shown in the installation drawings. Otherwise, we cannot guarantee proper operation of the burner/regenerator system.

- Check the floor or steel structure onto which the unit is to be placed to ensure that it has the necessary load-bearing capacity, taking into account the appropriate safety allowances. If required, reinforce the floor/support according to the manufacturer specifications by installing a supporting foundation or reinforcing the steel structure.
- Prepare location of installation. Ensure that there are suitable transportation routes to the location of installation. Clear the area to provide ample space for manoeuvre around the location of installation.
- The pipelines must be dimensioned so that condensate collection is prevented. If necessary, install suitable water traps and condensate drains and valves at the appropriate points. These points are typically located at the following locations:
 - Lowest point in the pipeline
 - At the base of the burner
 - At the primary air fans
- All welding work must be carried out by suitably qualified welders. Carefully clean all welds and test them for leakage.

7.3 Installation

7.3.1 Installation of system

- All installation work must be carried out by specialist personnel.
- All work must be carried out according to the instructions of the manufacturer.

Preparation for installation

Before mounting the burner to the furnace, apply suitable sealing material to the furnace wall.

Preassemble the burner as close as possible to its final installation position.

Installation options

Depending on the actual site conditions and the size of the burner/regenerator, there are a number of options for transportation and installation:

- **Option 1:**
The burner and regenerator are fully preassembled and connected to each other. This assembled unit must be placed in its final position and bolted to the furnace wall.
- **Option 2:**
The burner is first mounted to the furnace in accordance to the order-specific design drawing. Subsequently, the regenerator is connected to the burner. In certain cases, this requires an adapter.

Installation and commissioning

7.3.1.1 Assembly option 1



NOTE!

With this installation option, you must align the mounting flange and connecting bolts to the flange seal in the furnace wall.

1. Remove the packaging from all components and dispose of it according to the instructions printed on the packaging material and the applicable waste handling regulations.
2. Open the filling gate at the top of the regenerator.
3. Ensure that the regenerator discharge gate is properly closed.
4. Carefully clean the connecting surfaces between the burner and the regenerator and allow them to dry.
5. Connect the adapter and burner (⇒ *order-specific design drawing*) using the installation tools (included in delivery) and ensure that they are properly aligned.
Apply high-temperature grease to the threads of the bolts and tighten them with the prescribed torque.



NOTE!

Proceed with great care when working on the burner. Always provide proper support for the burner.

6. Mount the seal at the furnace.
7. Lift the assembled unit and secure it to the sealing flange. Tighten the bolts with the prescribed torque.



NOTE!

If necessary, place supports under the assembled unit.

8. Fill the media bed in the regenerator with ceramic beads. Ensure that the refractory lining of the regenerator is not damaged in the process.



NOTE!

A suitable measured batch of ceramic beads is included in the delivery.

9. Distribute the ceramic beads so that the entire bed is properly covered. The ceramic bead filling level must be below the connecting flange of the burner (⇒ *order-specific design drawing*).
10. Remove any foreign object that might have entered the regenerator during bead filling.

Installation and commissioning

11. Clean the seat of the filling gate.
12. Apply sealing material to the seat of the filling gate.
13. Carefully lower the gate cover on the gate seat.
14. Apply high-temperature grease to the threads of the bolts and the cover holders (included in delivery).
15. Tighten the bolts with the prescribed torque.
16. Complete the above installation steps for all burners and regenerators to be installed.

Installation and commissioning

7.3.1.2 Assembly option 2

Position the regenerator at its location of operation.

1. Remove the packaging from all components and dispose of it according to the instructions printed on the packaging material and the applicable waste handling regulations.
2. Mount the seal at the furnace.
3. Carefully align the burner to the sealing flange and secure it to the furnace. If necessary, use auxiliary support equipment (⇒ *order-specific drawing*).
4. Position the regenerator above/below the burner. If necessary, install an adapter.
5. Connect the burner and the regenerator, using the installation tools (included in delivery). Apply high-temperature grease to the threads of the bolts and tighten them with the prescribed torque.
6. If necessary, place supports under the burner and regenerator, align them and secure them to the floor or the steel support structure.



NOTE!

Ensure that the regenerators can be easily replaced at a later stage.

7. Remove lifting gear.
8. Open the filling gate at the top of the regenerator.
9. Ensure that the regenerator discharge gate is properly closed.
10. Fill the media bed in the regenerator with ceramic beads. Ensure that the refractory lining of the regenerator is not damaged in the process.



NOTE!

A suitable measured batch of ceramic beads is included in the delivery.

11. Distribute the ceramic beads so that the entire bed is properly covered. The ceramic bead filling level must be below the connecting flange of the burner (⇒ *order-specific design drawing*).
12. Remove any foreign object that might have entered the regenerator during bead filling.
13. Clean the seat of the filling gate.
14. Apply sealing material to the seat of the filling gate.
15. Carefully lower the gate cover on the gate seat.

Installation and commissioning

16. Apply high-temperature grease to the threads of the bolts and the cover holders (included in delivery).
17. Tighten the bolts with the prescribed torque.
18. Complete the above installation steps for all burners and regenerators to be installed.

7.4 Connection to power supply

All connection work described below must be carried out in compliance with the order-specific instructions of the manufacturer (installation drawing, diagrams).

Always comply with the applicable standards and statutory regulations.

Media

After successful installation of the burner and the regenerator, connect the following media supply lines:

- Air and natural gas to the pilot burner
- Primary air
- Secondary air
- Fuel gas or oil
- Exhaust gas

IMPORTANT! The pilot and the main burners are equipped with filter systems that ensure that the combustion air, fuel gas or fuel oil are sufficiently clean before they enter the burners. The supply of contaminated fuel gas/air mixture over a prolonged period of time has the following consequences:

- Poor ignition
- Inefficient combustion
- Accelerated contamination of the regenerators

Installation and commissioning

7.5 Commissioning

Leakage test

- External leakage inspection:
Apply leakage testing agent to the pressurised pipe connections and welded seams and check whether bubbles occur.
- Seal leaks properly.

Inspection for obstruction

- Check the burner opening to the furnace to ensure that it is not obstructed.

Adjustment of safety valves and pressure switches

- Adjust the supply pressures for gas and air at the burner.
- Check the safety valve and pressure switch settings and adjust them, if necessary (⇒ *technical data sheet*).

Test run

- Record the unit parameters (measured values) for proper normal operation and file the records for future reference.

8 Operation

8.1 Safety

WARNING

All operating steps must be carried out according to the instructions in this operating manual!

At the beginning of the shift ensure that all covers, guards and safety devices are safely installed and working properly!

Never disable safety devices while the unit is in operation!

Keep the working area clean and tidy! Loosely stacked components and tools can cause injury!

Improper operation results in serious injury or damage to property.

Personal protective equipment

The following personal protective equipment must be worn when operating the unit:

- Protective clothing
- Safety footwear
- Protective goggles
- Hard hat
- Hearing protection

Operation

8.2 Steps before use

- Open the manual stop valves.

8.3 Switching on

The unit must be started and run up according to best practice and the relevant instructions in the applicable standards.

Depending on the type and configuration of the furnace control system (MCR equipment), the procedures described below might be fully or partly automated.

1. Actuate the main switch.
2. Flush the system to prevent excess concentrations of combustion gases in the furnace chamber.
3. Complete the start-up procedure for the pilot burner.
4. Complete the ignition procedure for the main burners.

The burner/regenerator system is now in operation.

After start-up the burner does not require any further operator intervention.

8.4 Switching off

1. To shut down the unit, complete the relevant procedure implemented in the control system of the unit.
2. If required, set the unit to cooling mode to accelerate the cooling process for the furnace, burners and regenerators.

8.5 Shutdown in the event of an emergency

- In the event of danger, immediately stop the unit by pressing an emergency-stop button.
- Shut off the fuel and air supply to the burners.
- Take suitable safety measures.

The burners do not feature a built-in mechanism for the shutting down of the fuel and air supply.

It is therefore necessary to install quick-closing valves in the supply lines to the burners. These valves must conform to the relevant applicable safety regulations.

Maintenance

9 Maintenance

9.1 Safety

DANGER

Before carrying out any work at the units, disconnect the electric power supply and secure it against inadvertent reconnection!

Contact with powered components can cause death. Powered parts might perform unexpected movements that can cause serious injury.

WARNING

Before starting any work, ensure that you have the necessary room for manoeuvre!

Keep the unit site clean and tidy! Loosely stacked components and tools can cause injury!

If components were removed, ensure that they are properly aligned when remounting them again. Mount all fixtures and tighten the bolts with the prescribed tightening torque!

Improper maintenance can result in serious injury or damage to property.

WARNING

Proceed with great care when carrying out the following work! Wear personal protective equipment!

Even if the burner system is shut down, the surfaces of certain components might still be hot. Under certain circumstances, this heat might lead to serious injuries from burns when a person stands close to the equipment or touches it.

WARNING

Observe the safety instructions in the manufacturer data sheet of the refractory lining!

During all inspection and maintenance work on the refractory lining and associated components, wear appropriate personal protective equipment!

Dust particles in the regenerator might be carcinogenic when inhaled. After prolonged standstill, dust might deposit in the regenerator and become airborne when work is carried out.

Personnel

- The maintenance work described here cannot be executed by the operator unless otherwise indicated.
- Some maintenance tasks can only be executed by trained qualified personnel, or only by the manufacturer. In these cases this is separately indicated in the description of the specific maintenance tasks.
- All work on the electrical equipment should only be executed by a qualified electrician.

Personal protective equipment

For all maintenance work, wear the following protective equipment:

- Protective clothing
- Protective gloves
- Safety footwear

**NOTE!**

A warning symbol in this chapter indicates whether additional protective equipment is required for specific work.

Environmental Protection

Comply with the following environmental protection instructions when performing maintenance work:

- Wipe any emerging, used or excessive grease off all lubrication points that need to be manually supplied with lubricant, and dispose of in compliance with local regulations.

Maintenance

9.2 Maintenance Schedule

Maintenance tasks that are required for optimum and trouble-free operation are described in the sections below.

If increased wear is detected at regular inspections then the required maintenance intervals must be shortened by the customer to correspond with the actual signs of wear.

Contact the manufacturer for questions on maintenance work, see the service address on page 2.

Interval	Maintenance task	To be carried out by
After the first 3 months of operation, upon each service of the unit	Check the burner connections and the regenerator for leakage	Unit operator
	Check and clean burner head	
Monthly, when the prescribed max. pressure loss level is reached	Check and clean the inside of the regenerator and the ceramic beads	
	Check and clean burner head	
Annually, upon furnace service or after the regenerator has been removed	Check burner block and refractory lining	
	Complete a visual inspection of the seal between the burner and the furnace wall	
	Check the burner and regenerator for dirt and clean them, if necessary	

9.3 Maintenance tasks

9.3.1 Check burner connections for leakage

- To be carried out by the operator.
- Required additional protective equipment:
 - Protective gloves
 - Protective clothing
- Tools:
 - Foam leakage tester

All bolt and flange connections at the burner must be regularly tested for leakage.

These tests are to be carried out when the unit is in operation.

1. Apply leakage testing agent to the bolt connections and then the flange connections.
2. Check whether there are any bubbles.
Bubbles indicate leaks.
3. In the event of bubbles, tighten the respective connection until no bubbles are formed.

9.3.2 Cleaning regenerator and ceramic beads

⚠ WARNING

Before carrying out any work at the regenerators, shut down the burner system and allow the regenerators to cool down. The cooling process can be accelerated by feeding cold air through the regenerators. To do this, it might be necessary to manually adjust the position of the air valves.

Even if the burner system is shut down, there might be considerable residual heat in the regenerators and the medium that might not be easily detected. Under certain circumstances, this heat might lead to serious injuries from burns when a person stands close to the equipment or touches it.

Maintenance

⚠ CAUTION

Never clean just one regenerator! As soon as there is a need to clean one of the regenerators, always clean all regenerators within the same unit section.

The unit control system is designed in such a way that all regenerators are exposed to similar loads and conditions. In the event of irregular pressure loss in the regenerators, the unit control system might not be able to detect this and initiate the necessary compensatory measures. This can lead to irregular air flow which in turn might result in loss of performance and even damage due to local overheating.

⚠ CAUTION

Proceed with great care when emptying and cleaning the regenerator.

Use only tools made from a soft material (e.g. wood). Never use chisels, crow bars or similar tools to remove encrusted materials. Do not attempt to remove residue and dust deposits that are difficult to lift from the surface. If these deposits impair the regenerator function, contact the manufacturer to arrange for the renewal of the refractory lining. Do not attempt to remove residue and dust deposits that are difficult to lift from the surface. If these deposits impair the regenerator function, contact the manufacturer to arrange for the renewal of the refractory lining.

The refractory lining of the regenerator is easily damaged by impacts or scratching. The use of unsuitable tools can lead to damage to the lining that requires repair.

IMPORTANT

Ash and dust residue collected during the above work is hazardous waste and must be disposed of accordingly. This also applies to washing residue containing such particles. Collect the material and dispose of it according to the applicable statutory regulations.

- To be carried out by the operator.
- Required additional protective equipment:
 - Protective goggles
 - Protective gloves
 - Protective overall
 - Fine dust mask/light-duty respiratory protection equipment

■ Tools:

- Broom or industrial vacuum cleaner
- Scoop/scrapper with long handle
- Container of suitable capacity and strength for the temporary storage of the ceramic bead load of one generator



NOTE!

To reduce the time required for the maintenance tasks described below, we recommend keeping a dry and cleaned ceramic bead load ready for each regenerator.

For units with removable regenerators, we recommend keeping a reserve regenerator ready.

Dust and other airborne particles from the combustion air in the furnace chamber deposit on the ceramic bead bed and gradually increase its drag, leading to a pressure loss across the generator. When a set limit pressure loss is reached (normally approx. 40 mbar, depending on unit), a warning must be displayed at the unit control system.

In such a case, the regenerators and the ceramic beads must be cleaned without delay (alternatively, the regenerators must be cleaned and filled with the clean reserve material, or the regenerator must be replaced).

Preparation

1. Shut down the burner system.
Keep the following cooling air supply lines open:
 - Line to gas lances
 - Line to UV cell
 - Line to pilot burner
2. Allow the regenerator to cool down.
This process might be accelerated by feeding cold air through the system.
3. Complete the following steps at each regenerator.

9.3.2.1 Remove ceramic beads

1. Place the container for the temporary storage of the ceramic bead load in front of the discharge gate of the regenerator.
2. Open the discharge gate.
3. Empty all ceramic beads from the regenerator bed into the container. To do this, use a clean scoop and scrapper with a long handle.

Maintenance

4. Open the filling gate, attach the cover to suitable lifting gear or use a forklift truck to move it to a safe position.
5. If necessary, insert the cleaning tools through the filling opening to remove any remaining ceramic beads from the regenerator grate.

9.3.2.2 Clean regenerator

1. Remove dust deposits and easily removable encrusted material with a broom or industrial vacuum cleaner from the regenerator chamber.
2. Carry out a visual inspection of the refractory lining. Repair minor defects with refractory cement. If there are major defects, contact Bloom Engineering and have the entire refractory lining renewed.
3. Apply high-temperature grease to the hinges of the discharge gate (model 1) to prevent stiffness.

9.3.2.3 Clean ceramic beads

1. Let the ceramic beads run through a screen (recommended mesh size: 10°mm) to remove larger foreign objects and deposits.
2. Rinse the ceramic beads with water. To do this, place the beads in a cement mixer and let it rotated slowly, or move them with a scraper in plenty of water.

IMPORTANT! When moving the ceramic beads, proceed with great care to prevent damage to the material. Check the beads carefully for damage caused in the washing process.

The cleaning process is completed when all beads are free of dust and dirt residue.

3. Let the ceramic beads run through a screen (recommended mesh size: 10 mm) and dry them.
4. During the cleaning process, add new beads to compensate for removed or lost beads to ensure that the prescribed filling weight is reached.

9.3.2.4 Fill regenerator with ceramic beads

1. If required, repair or replace the seal of the drainage gate.
2. Carefully close the drainage gate cover and secure it with the bolts.
3. Tighten the bolts with the prescribed torque.
4. Fill the media bed in the regenerator through the filling gate with ceramic beads.
Ensure that the refractory lining of the regenerator is not damaged in the process.
5. Distribute the ceramic beads so that the entire bed is properly covered.
6. Remove any foreign object that might have entered the regenerator during bead filling.
7. Clean the seat of the filling gate.
8. Apply sealing material to the seat of the filling gate.
9. Carefully lower the gate cover on the gate seat
(⇒ *order-specific drawing*).
10. Apply high-temperature grease to the threads of the bolts and the filling cover holders (included in delivery).
11. Tighten the bolts with the prescribed torque.

9.3.3 Check and clean burner

⚠ WARNING

Before carrying out any work at the burners, shut down the burner system and allow the burners to cool down. The cooling process can be accelerated by feeding cold air through the burners.

Even if the burner system is shut down, there might be considerable residual heat in the burners that might not be easily detected. Under certain circumstances, this heat might lead to serious injuries from burns when a person stands close to the equipment or touches it.

Maintenance

⚠ CAUTION

When cleaning the burners, proceed with great care. Use only tools made from a soft material (e.g. wood). Never use chisels, crow bars or similar tools to remove encrusted materials.

Do not attempt to remove residue and dust deposits that are difficult to lift from the surface. If these deposits impair the burner function, contact the manufacturer to arrange for the renewal of the refractory lining.

The refractory lining of the burner is easily damaged by impacts or scratching. The use of unsuitable tools can lead to damage to the lining that requires repair.

IMPORTANT

Ash and dust residue collected during the above work is hazardous waste and must be disposed of accordingly. Collect the material and dispose of it according to the applicable statutory regulations.

- To be carried out by the operator.
- Required additional protective equipment:
 - Protective goggles
 - Protective gloves
 - Protective overall
 - Fine dust mask/light-duty respiratory protection equipment
- Tools:
 - Timber pole
 - Broom or industrial vacuum cleaner

Preparation

1. Shut down the burner system.
2. Allow the burner to cool down.
This process might be accelerated by feeding cold air through the system.

Complete the following steps at each burner:

1. Carefully clean the burner block and the swirl plate from deposits and other foreign particles.
2. Check the burner block and nozzle block for cracks. Repair clearly visible cracks with refractory cement.



NOTE!

Small cracks up to a width of 1 mm are normal and are closed when the material expands at high temperatures.

3. Check gas/oil lance for damage.

9.3.4 Check seal between burner and furnace chamber

- To be carried out by the operator.
- Required additional protective equipment:
 - Protective goggles
 - Protective gloves
- Carry out a visual inspection for leakage of the seal between the burner port and the furnace chamber.
If necessary, replace the seal.

Maintenance

9.4 Measures after maintenance

Perform the following steps after completing maintenance and before switching on the machine:

1. Check all previously loosened screw connections for a tight fit.
2. Check whether all previously removed protective devices and covers are properly installed again.
3. Make sure that all tools, materials and other equipment used were removed again from the work area.
4. Clean up work area and remove any substances left over, such as fluids, processing material or the like.
5. Make sure that all safety features on the machine are fully functional.

10 Troubleshooting

The following chapter describes possible causes of faults and the steps required to eliminate them.

In the event of frequent faults, reduce the maintenance intervals to correspond to the actual working load.

In the event of faults that cannot be eliminated through the following instructions, please contact the manufacturer (service address on page 2).

10.1 Safety

⚠ DANGER

Before carrying out any work at the units, disconnect the electric power supply and secure it against inadvertent reconnection!

Contact with powered components can cause death. Powered parts might perform unexpected movements that can cause serious injury.

⚠ WARNING

Before starting any work, ensure that you have the necessary room for manoeuvre!

Proceed with great care when handling components with sharp edges!

Keep the unit site clean and tidy! Loosely stacked components and tools can cause injury!

Mount all components according to best practice! Tighten the bolts with the prescribed tightening torques!

if necessary, secure components to prevent them from falling or tipping!

Improper installation and commissioning can result in serious injury or damage to property.

Personnel

- The troubleshooting procedures described here can be performed by the operator unless otherwise marked.
- Some work may be performed only by specially trained personnel or only by the manufacturer, in which case special notice is given in the description of the individual faults.
- All work on the electrical system must be performed by a qualified electrician.

Troubleshooting

Personal protective equipment

For all maintenance work, wear the following protective equipment:

- Hard hat
- Protective gloves
- Protective clothing



NOTE!

A warning symbol in this chapter indicates whether additional protective equipment is required for specific work.

Behaviour in the event of malfunctions and faults

The following principle applies:

1. In the event of malfunctions or faults that might pose a direct threat to persons or property, immediately shut down the unit with an emergency-stop device.
2. Identify the cause of the malfunction or fault.
3. If the elimination of the malfunction requires work to be carried out in the danger area, shut down the unit and secure it against inadvertent switching on.
4. Depending on the type of the malfunction or fault, it might be necessary to deploy specialist personnel to carry out the necessary repair work.

10.2 Malfunction Indicators

The following devices indicate malfunctions:

10.2.1 Control system

All measuring, control and regulating functions are carried out by a separate unit control system. This system is equipped with an integrated fault management system that indicates possible faults and malfunctions in plain text or by means of numerical codes (⇒ *separate documentation of control system*).

The steps required for the elimination of the fault or malfunction must be explained in help texts shown by the MCR system, or in the unit-specific documentation. These steps must be carried out in accordance with the instructions.

10.2.2 Burners and regenerators

The burners and regenerators are not equipped with a separate fault display system.

When attempting to locate a fault, always also check the fittings and devices of the supply lines.

10.3 Fault table

Fault/malfunction	Possible cause	Remedy	To be carried out by
No flame	Incorrect fuel/air ratio	Check supply lines	Specialist staff
	Regenerator dirty	Clean regenerator (⇒ Chapter <i>Maintenance</i>)	
	Air nozzle blocked or damaged	Check and clean burner head (⇒ Chapter <i>Maintenance</i>)	
	Fuel nozzle worn	Replace fuel nozzle	Manufacturer

Startup after eliminating fault

After elimination of the cause of the danger, carry out the following steps for restart of the unit:

1. Acknowledge the malfunction or fault at the control system.
2. Ensure that no persons are standing in the danger area.
3. Start the unit according to the instructions in chapter "Operation".

Disassembly

11 Disassembly

When the system has reached the end of its service life it must be dismantled and disposed of in an environmentally responsible manner.

11.1 Safety

DANGER

Before starting dismantling the unit, disconnect it from the electric power supply.

Contact with powered components can cause death. Powered parts might perform unexpected movements that can cause serious injury.

WARNING

Before starting any work, ensure that you have the necessary room for manoeuvre!

Proceed with great care when handling components with sharp edges!

Keep the workplace clean and tidy! Loosely stacked components and tools can cause injury!

Dismantle all components according to best practice! Please note that some parts are very heavy. If necessary, use suitable lifting gear.

Secure components properly to prevent them from falling or tipping!

If unsure how to secure or dismantle parts, consult the manufacturer.

Residual energy, sharp edges, pointed corners, etc. can cause injury.

WARNING

Observe the safety instructions in the manufacturer data sheet of the refractory lining!

During all inspection and maintenance work on the refractory lining and associated components, wear appropriate personal protective equipment!

Dust particles in the regenerator might be carcinogenic when inhaled. After prolonged standstill, dust might deposit in the regenerator and become airborne when work is carried out.

⚠ WARNING

**Proceed with great care when carrying out the following work!
Wear personal protective equipment!**

Even if the burner system is shut down, the surfaces of certain components might still be hot. Under certain circumstances, this heat might lead to serious injuries from burns when a person stands close to the equipment or touches it.

Personnel

- Disassembly must always be performed by specially trained personnel.
- All work on the electrical system must be performed by a qualified electrician.

11.2 Dismantling

Clean the burner and regenerator and dismantle them with reference to the applicable occupational safety and environmental protection regulations.

11.3 Disposal

Unless a return or disposal contract has been entered into, dispose of the dismantled components for recycling as follows:

- Scrap metals.
- Sort other components by material and dispose of separately.

Contract the local waste management authorities or specialist waste disposal company with the disposal of the material.

Spare parts

12 Spare parts

In order to minimise downtime in the event of a defective part and for maintenance, Bloom Engineering recommends keeping the following spare parts in stock at the site of operation:

- 1 burner block per burner/regenerator system
- 1 regenerator ceramic bed filling
- 1 set of seals

When ordering spare parts, always include the following information in your order:

- Order number
- Unit order number

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